جامعة المستقبل

كلية التقنيات الصحية والطبية

قسم تقنيات البصريات

Second Stage 2024-2025

REFRACTIVE ERRORS 1

Lecture Title

Mirror & lens

Lecture Number: 2 / course 1

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OPTOMETRIST

Mirror & lens

MIRROR: a smooth, highly reflective surface that typically reflects light to form an image of whatever is in front of it. Mirrors work by reflecting incoming light rays at the same angle at which they strike the surface, according to the law of reflection. The most common type of mirror is a plane mirror, which has a flat surface and reflects images in their true proportions, though reversed left-to-right.

Types of Mirrors

1. **Plane Mirrors**: Flat mirrors that reflect light uniformly, producing virtual images that are the same size as the object.
2. **Spherical Mirrors**: Curved mirrors that can be either concave (converging) or convex (diverging).
   - ✓ **Concave mirrors (converging mirrors):** curve inward like the inside of a bowl, focusing light rays to a point and often magnifying the image.
   - ✓ **Convex mirrors (diverging mirrors):** curve outward like the back of a spoon, spreading light rays outward and typically making the image smaller.

Properties of Images Formed by Plane Mirrors

- Image Type: Virtual (cannot be projected on a screen).
- Image Orientation: Upright.
- Image Size: The same size as the object.
- Image Distance: The image appears to be the same distance behind the mirror as the object is in front of it.
- Lateral Inversion: The image is laterally inverted, meaning left and right are reversed.

LENSES: **An optical lens (or simply a lens) is a piece of transparent material that is shaped so that it refracts light rays to focus at a certain point – called the focal point.**

Lenses are used for spectacles, magnifying glasses, microscopes, and slide projectors. Spectacle lenses can change the focus of the eyes, so that sight becomes clearer.

If an eye has a refractive error (like hyperopia, myopia, astigmatism or presbyopia), a spectacle lens can be used to correctly focus the light coming into the eye so that the vision becomes clear.

Lenses are usually made of glass or plastic, and they come in many shapes. The most common lens shapes are:

- **Spherical: plus and minus lenses**
- **Astigmatic: cylindrical and sphero-cylindrical lenses**

A lens will bend light rays by different amounts depending on the refractive index of the lens material, and where on the lens surface the incident light ray enters.

Plus Lens: also known as a convex lens or converging lens, is a type of lens that is thicker at the center than at the edges. It is called a "plus" lens because it has a positive focal length, meaning it converges parallel light rays to a single point known as the focal point.

Minus Lens: also known as a concave lens or diverging lens, is a type of lens that is thinner at the center and thicker at the edges. It is called a "minus" lens because it has a negative focal length, meaning it diverges parallel light rays away from a point known as the focal point.

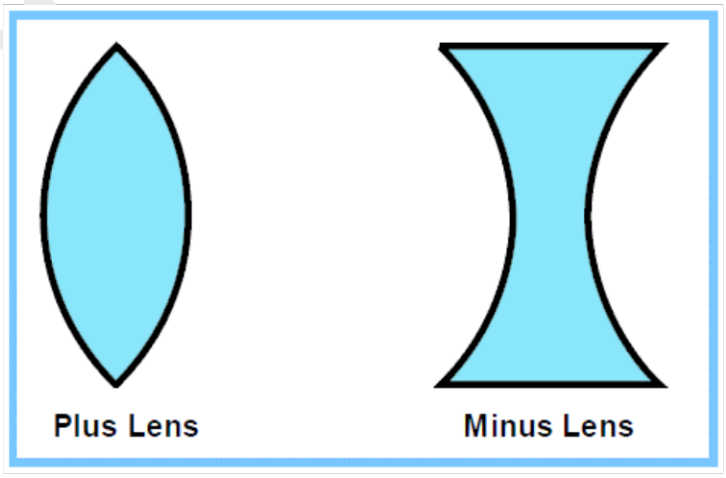
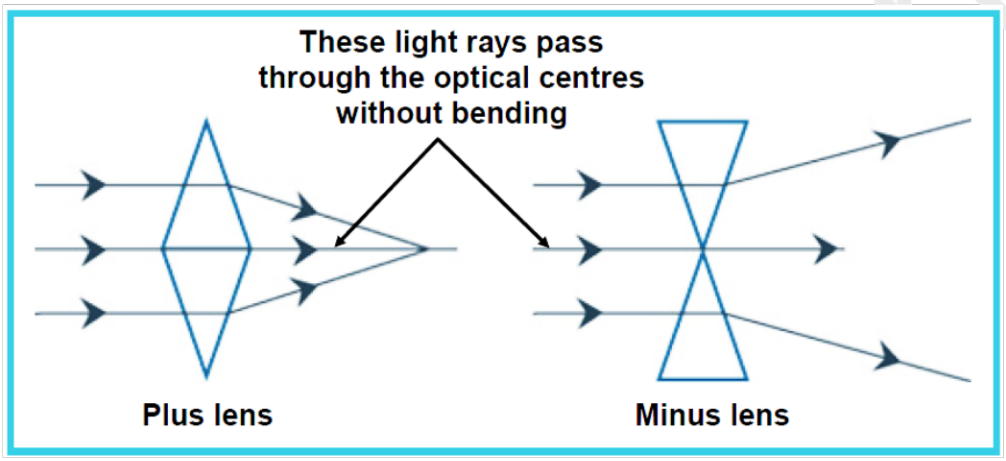


Figure 1: *Plus and minus lenses*

Optical Centre: A light ray will not be refracted or bent if it travels through the optical center of a lens.

A plus lens can be thought of as two prisms that are joined base to base.
A minus lens can be thought of as two prisms that are joined apex to apex.



Astigmatic lenses: are specially designed lenses used to correct astigmatism, a common refractive error in which the eye does not focus light evenly on the retina due to an irregularly shaped cornea or lens. This irregular shape causes blurred or distorted vision because light rays are refracted differently depending on their orientation.

Types of Astigmatic Lenses

- **Cylindrical Lenses:** have different curvatures in different meridians (directions) of the lens, which allows them to focus light along one axis more than the other. These lenses correct astigmatism by compensating for the uneven curvature of the cornea or lens.

The prescription will typically have three components: spherical power is zero, cylindrical power, and axis.

$0.00 / \pm 1.00 \ X \ 90^{o}$

- **Spherocylindrical Lenses:** combine both spherical and cylindrical components in one lens. The spherical component corrects nearsightedness (myopia) or farsightedness (hyperopia), while the cylindrical component corrects astigmatism.

The prescription will typically have three components: spherical power, cylindrical power, and axis.

$$\pm 0.50 / \pm 1.00 \ X \ 90^{o}$$

HOME WORK

- **Describe the types of lenses and their uses in correcting vision. Explain how a plus lens and a minus lens work to correct refractive errors like myopia and hyperopia.**
- **Explain what astigmatism is and how astigmatic lenses correct this condition. Describe the difference between cylindrical lenses and spherocylindrical lenses.**
- **Write a comparison between convex and concave lens**